STRUCTURAL ANALYSIS AND COMPUTATIONS
FOR INDIVIDUAL
ADHACO HROIZONTAL BLAST STRIKE AND LATCH
TYPE H-122

The following analysis and computations indicate the key phases of the structural strength of the individual Adhaco horizontal Blast Strike and Latch.

The blast strike and latch is constructed primarily of components made of grade A malleable iron, grade 35018, conforming to ASTM A-47-52.. Opperating rods and strike rollers for complete assembly are constructed from cold finished rounds conforming to A1S1 c1018.

Physical properties of the grade 35018 malleable from are:

Tensile strength:	53,000 psi
Yield strength	35,000 psi
Elongation in 2 inches:	18%
Shear strength:	48,000 psi
Yield shear strength:	23,000 psi

Considering that these values demonstrate ductile materials behavior. it is appropriate to consider an increase for dynamic effects.

The properties of the c1018 cold finished steals are:

Tensile strength:	48,000 psi
Yield strength	64,000 psi
Elongation in 2 inches:	15%
Yield shear strength:	27,000 (Assumed)

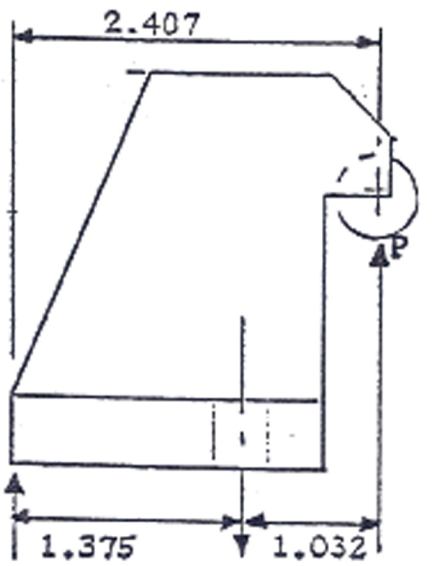
For the purpose of analysis the values for steels used are taken as: 40,000 psi for tension and compression and 20,000 psi in shear. The H-122 horizontal blast strikes and latches are analyzed herein:

The individual blast latch assembly is composed of three components- the strike, latch tongue, and latch housing. The blast latch assemblies need resist only negative loads since positive loads are resisted by the bearing of the door on the frame.

1. Blast Resistant Strike:

The strike fastening bolts are 1/2" diameter socket head cap screws having assumed tension capacity of 70,000 psi and an area for tensile strength of .142 sq. in. for a load capacity of .142 (70,000) = 9,950 lb.

Considering uplift of the strike as shown below



the value of P can be found for two and three bolts. The capacity for two bolts is:

$$2.407\ P = 2(9950)\ \ (1.375)$$

$$P = 11{,}300\ \text{lb}$$

The outstanding legs of the casting are 5/8 in. thick and two inches wide. If the effective width is taken as 1¼,the plastic moment capcity would be:

$$\frac{1.25(.625)^2}{4}\ \ (40{,}000) = 4880\ \text{lb. in.}$$

The limited capacity of these legs is:

$$\frac{3}{4} p^* = 4880$$

$$p^* = 6520 \text{ lb.}$$

The assoicated capacity of the strike for two bolts would be:

$$P = \frac{6520}{9950} \times 11{,}300$$

$$P = 7450 \text{ lb.}$$

The roll pin is subjected to double shear. The strength is 7700 lb.. (This value is taken from the Elastic Stop Nut Corp. of America, Union, New Jersey, Roll Pin catalong (1958) P. 14)

The casting holding roll pin is subject to shear above the roll pin. The area of casting in shear is:

$$2 \left(\frac{3}{4}\right)\left(\frac{3}{4}\right) = 1.12 \text{ sq. in.}$$

The associated capacity of this area is:

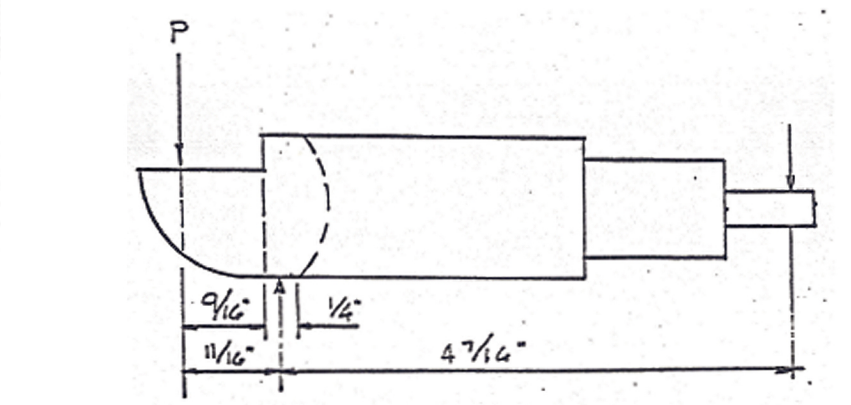
$$1.12 \ (20{,}000) = 22{,}400 \text{ in.}$$

It is important to note that if the roll pin fails, the machined surface of the tongue would simply contact the casting directly. This would not influence operation of the door.

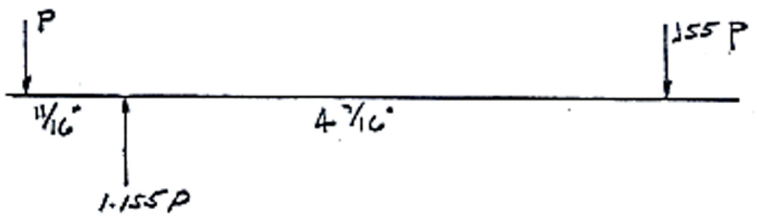
The limiting strength of the strike is 7450 lb.

Latch Pin (Tongue)

The tongue fits tightly into the multi-point latch housing at the strike end. The support of the tongue is as shown below:



The load P is the load to be resisted - the limiting strength is thru the whole in the tongue. The reactions are:

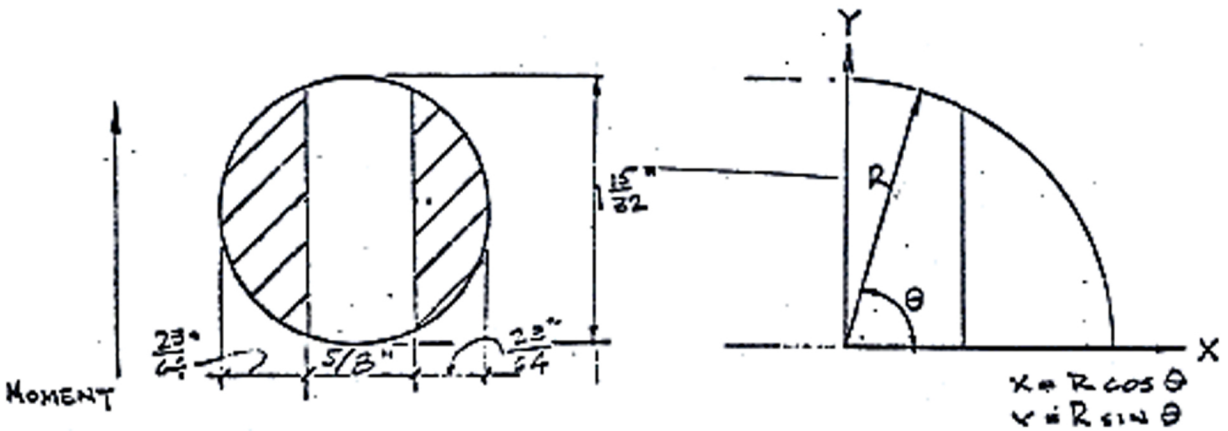


The maximum moment thru the hole in the tongue is:

if P is in lb. this moment is in lb. in.

The strength of the tongue is found by considering bending thru the slotted section

Tongue (Ref. dwg. 422-L04-B and H-120)



$$A = \int ydx \qquad dx = -R \sin\theta \, d\theta$$

$$A = \int_{0^\circ}^{64.8^\circ} -R^2 \sin^2\theta \, d\theta = -R^2 \left[\frac{\theta}{2} - \frac{\sin 2\theta}{4} \right]_{0^\circ}^{64.8^\circ}$$

$$= -R^2 (.566 - .193) = -.373 \, R^2$$

$$M_x = \int_{64.8^\circ}^{0^\circ} \frac{y^2\,dx}{2} = \frac{-R^3}{2} \int \sin^3\theta\, d\theta$$

$$= \frac{-R^3}{2}\left[\frac{\cos^3\theta}{3} - \cos\theta\right]_{64.8^\circ}^{0^\circ}$$

$$= \frac{-R^3}{2}\,(.0257 - .426 - .333 + 1) = .133\,R^3$$

$$\bar{y} = \frac{.133R^3}{.373R^2} = .360\,R$$

R = .7344"

$$A = .373\,(.7344)^2 = 0.201 \text{ in.}^2$$

$$\bar{y} = .360 \times (.7344) = .264 \text{ in.}$$

$$M_p = .201\,(.264)(40{,}000)(4) = 8450 \text{ lb. in.}$$

The limitation on P, therefore is:

$$.668P = 8450 \text{ lb. in.}$$

$$P = 12{,}600 \text{ lb}$$

The area is 4(.201) = .804 sq. in.

The associated shear strength is:

$$20{,}000\ (.804) = 16{,}080 \text{ lb.}$$

this relates to a load of:

$$.155P = 16{,}000$$

$$P = 103{,}000 \text{ lb.}$$

Considering a linear relastionship between bending and shear stress results in:

$$\frac{P}{103,000} - \frac{P}{12,600} = 1$$

$$P(1 \div 8.2) = 103,000$$

$$P = \frac{103,000}{9.2}$$

$$P = 11,200$$

The limiting strength of the pin is, therefore, 11,200 lb.

3. Multi point latch Housing:

Since the latch assembly is effective only for negative loads, the housing is required only to hold the tongue in place. The latch assembly will tend to lift about the edge closest to the strike. the 3/8" diameater socket head cap screws have an effective area of .075 sq. in.. The yield strength of the screw material is 170,000 psi - for the purpose of anaalysis 70,000 psi is used, therefore, each screw has a potential strength of .078 (70,000) - 5460 lb.. considering only the two furthest screws this is equivalent to a capcity of:

$$9/16\ P = 4(2)(5460)$$

$$P = 78,200 \text{ lb.}$$

The housing and attachment is, therefore, adequate.

Conclustion:

For the H-122 design (using 2 bolts in the strike) the strength is governed by the strike to a strength of 7450 lb.